cannot always contain questions that would be most suitable for one particular mode of teaching. The kind of questions set would be of a different nature if the giving of the questions devolved upon those who had in hand the teaching. Those who have the teaching can give an examination vastly more useful and one that would re-act on the teaching in a way that an examination of a multitude of students trained at all kinds of institutions, and many merely by private reading, could not possibly do. Therefore, it seems to be a matter of high importance indeed that there should be a University of Wales; that you should consider it to be a great object to be attained, sooner or later—but the sooner the better—the establishment of the University of Wales, with the University College of North Wales an integral part of it. I have much pleasure in wishing the University College of North Wales every success, and I trust that the laboratories now opened may prove of great value in promoting and aiding the study of science.

POLYNOMIALS IN ZOOLOGY[1]

SINCE the days of Linnæus scientific zoologists have universally adopted the binomial system of nomenclature, which was invented and introduced by that great naturalist. So long as the idea of the fixity of species, as originally created entities, prevailed, there was no excuse for deviating from the Linnean plan. Such an idea as a transitional series between two species, or the division of a species into two or more local forms, was hardly understood by the older authors. But of late years, since the general acceptance of the derivative origin of species, it has become universally acknowledged that sub-species and transitional forms do exist in Nature, and many and various plans have been proposed for indicating them. Trinomials—that is, the usage of three names, of which the last is that of the sub-species—are in great favour with a rising section of American zoologists, and there is much to be said in their defence. But the concession of three terms, it is said, would in some cases not be sufficient. Quadrinomials and Polynomials must necessarily follow, and render nomenclature inconveniently long. Mr. S. Garman, the well-known herpetologist of the Comparative Museum of Zoology at Harvard College, Cambridge, replies, in the pamphlet now before us, to the assertion "that there is no other or better method than "polynomials." Mr. Garman proposes to designate the different forms or sub-species of a species by symbols such as (A), (B), (C), (D). Supposing that the (C) form is found to consist of several sub-varieties he would name them $(C.^{a})$, $(C.^{b})$, $(C.^{c})$. Still further subdivisions might be indicated as forms (C^{a1}), (C^{a2}), (C^{a3}), and $(C^{a1'})$, $(C^{a1''})$, &c. Thus the polynomial "*Amblystoma tigrinum mavortium hallowelli suspectum maculatissimum*" would be reduced to "$(C.^{a1'})$ *Amblystoma tigrinum*," the "advantage" of which for general literature is "apparent"! But is not this a case in which it may be said that the proposed remedy is as bad as the disease?

[1] "On the Use of Polynomials and Names in Zoology." By S. Garman, Cambridge, Mass., U.S.A. From the *Proceedings* of the Boston Society of Natural History, March 19, 1884.

TEMPERED GLASS

WE are very pleased to be able to chronicle an application which Mr. Frederick Siemens has recently made in his regenerative gas radiating furnace, described in the autumn of last year (NATURE, vol. xxxi. p. 7). It consists in the production of glass which appears to be of a very homogeneous character and of considerable strength and hardness, and will doubtless become available for a number of useful purposes. The scientific principle which is applied in the three distinct processes to which we propose to refer shortly, is that of keeping the whole body of the glass at a uniform temperature during the operations of heating and cooling—that is to say, that at each unit of time the whole mass shall be at one temperature. Two methods have hitherto been employed by means of which glass has been rendered more or less independent of variation of temperature. The oldest of these is that carried on in the annealing kiln, in which the manufactured articles of glass are allowed to cool very slowly. The more modern is that of De la Bastie; in this process the finished articles of glass had generally to be annealed in the first instance, then heated to such a temperature as to soften them, when they were immersed in a bath of heated oil maintained at a temperature above 300° C., which was said to make them tough. The objection to annealing is mainly that of cost, but the objection to the De la Bastie process is that it is wrong in principle, as, owing to the manner in which cooling is effected, the glass is in a state of tension throughout, which is brought to evidence by means of the polariscope. The glass produced by the processes to be described are almost free from internal strain, and Mr. Siemens holds that, could the principle he propounds be carried out perfectly in practice, the glass would be free from tension throughout its whole mass. A corollary which may apparently be drawn from this proposition is that every metal not cooled in the way proposed is in strain; but that, owing to the much greater tensile strength of metals, the state of tension does not become evident in the same manner as in glass, which is notably brittle.

Press-hardened Glass.—Only glass of the very best quality is suitable for hardening. It is cut into the proposed shapes and placed in the radiation furnace until soft; it is then removed and placed between cold metal plates, and cooled down in the proportion of its volume or capacity for heat. Glass may be cooled so rapidly by this means that the diamond will not touch it; the process is mostly applied to sheet and plate glass, which may either be plain or decorated, and whose strength is thereby increased eight times. The degree of hardening which may be attained depends on the temperature to which the glass is heated and the rate at which it is cooled. The higher the temperature, and the more quickly the glass is cooled, the harder is the glass. Thus, for very quick cooling copper plates are used in the presses, and the glass is rendered exceedingly hard; when a less degree of hardness is desired, iron plates, or even these covered with asbestos, or clay slabs, may be employed.

Sheet-glass of ordinary thickness is heated in a minute and cooled in half a minute. It is remarkable that this can be effected in so short a space of time without injury to the glass, and is due to the uniformity of the heating and cooling operations. Owing to the high temperature at which this process is carried on, more refractory enamels, such as those used for porcelain, can be applied, and the enamel is thus rendered as indestructible as the glass itself.

Semi-hardening is employed for goods to which presses cannot be easily applied. The glass is heated up to a high temperature, but not to such a degree as to affect its shape, and is then placed within an iron casing having internal projecting ribs so arranged as to hold the glass article in position and to touch it at the fewest possible points. The casing with its inclosure is cooled in the open air. The process is only applicable to articles of nearly uniform thickness throughout; it increases the strength of the glass about three times, and renders it less liable to be effected by changes of temperature than ordinary glass is.

The third kind of glass, which is known as *hard-cast glass*, has not yet been introduced commercially, but samples of the work produced in the form of sleepers, tramway-rails, grindstones, and floor-plates were exhibited at the meeting. The method of production is very simple.

Glass made in a continuous glass-melting furnace is run into moulds as with iron castings. The only precaution that has to be taken is that the moulding material shall have as nearly as may be the same specific heat and the same conductivity for heat as glass. Various mixtures of materials that are easily obtainable and not costly are suitable, such as mixtures of powdered porcelain, glass pots, metal turnings and filings, and such minerals as heavy spar and magnetic iron ore. These are pulverised and mixed in certain proportions, and then moulded in the ordinary way. The glass being run into the mould, the mould and its contents are heated up together, and then cooled together, and, when cool, the mould is opened and the glass removed. Glass may thus be cast into forms which it would be impossible to produce otherwise. That glass may thus be manufactured of great homogeneity was proved by the clear ring of a large tuning-fork made of the material, and in the manner described. Mr. Siemens promises on a future occasion to bring this matter again before the Society of Arts, after the completion of the works which he is now erecting for the manufacture of glass according to the process last described. As regards the other processes, the manufacture has increased in six years from 600*l.* to 7000*l.*, and, considering the very cheap rate at which hard glass castings can be produced—viz. about 5*s.* 6*d.* a hundredweight—Mr. Siemens feels satisfied that a large business will be done, more particularly as they supply a want which is felt on all sides; and thinks that glass not being liable to oxidation, as soon as it could be depended upon as regards strength, it would be applied for purposes for which metals, stone, and porcelain have hitherto been used.

THE PHYSIOLOGICAL LABORATORY AND OXFORD MEDICAL TEACHING

[WE regret to learn that another attempt is being made to suppress physiological teaching at Oxford. The not-over-scrupulous foes of scientific teaching and research have, we understand, distributed manifestoes by thousands all over the country. We hope, therefore, that the following statement will receive equally wide circulation. Scarcely any of the well-known men who have signed the statement are in any way connected with what is generally known as science; certainly not one of them would have signed it had there been the least suspicion that in the Oxford Laboratory there would be any approach to cruelty:—]

A decree to provide for the expenditure of the department of Physiology will be submitted to Convocation on Tuesday, March 10. The annual sum required for this purpose is 300*l.*, besides 200*l.* for the salary of the Demonstrator of Histology.

The arrangements for the organisation of a complete system of instruction in the subjects of the first B.M. Examination and of the first and second Professional Examinations of the Conjoint Board of the College of Physicians and of the College of Surgeons in London are in progress, and will soon be completed. The new Lecturer on Human Anatomy will very shortly be appointed, and the Physiological Laboratory will be completed and ready for occupation by the end of the summer; so that before next October the University will be in a position to undertake the teaching of Human Anatomy and Physiology. The arrangements for teaching the other subjects in which instruction is required by medical students are also in progress.

As, in accordance with the recent resolution of the Colleges of Physicians and Surgeons, Candidates who have satisfied the Oxford Examiners in Anatomy, Physiology, and the other subjects of the first and second Professional Examinations, will be exempted from further examination in these subjects, Members of the University will in future be able to complete their first two years of medical study without leaving Oxford.

The purpose for which the expenditure is required is instruction not research, and no experiments upon the living animal involving pain will be used for demonstration to students or instruction, with or without anæsthetics.

It is, however, intended by those who desire absolutely to prohibit such experiments in physiological inquiry, to oppose the decree for the maintenance of the laboratory. Energetic measures are being taken to this end. The rejection of the decree would involve fatal consequences as regards the above-mentioned scheme for the teaching of medical science. The University has already twice pronounced upon the issues now sought to be raised, by votes taken in unusually full Convocations on June 5, 1883, and February 5, 1884. We, therefore, trust that you will be good enough to attend and vote in favour of the Decree on March 10, at 2 p.m.

H. G. LIDDELL, Dean of Christ Church.
J. FRANCK BRIGHT, Master of University.
GEORGE C. BRODRICK, Warden of Merton.
J. P. LIGHTFOOT, Rector of Exeter College.
DAVID B. MONRO, Provost of Oriel.
JOHN R. MAGRATH, Provost of Queen's.
J. E. SEWELL, Warden of New College.
W. W. MERRY, Rector of Lincoln.
W. R. ANSON, Warden of All Souls.
E. H. CRADOCK, Principal of B.N.C.
T. FOWLER, President of Corpus.
J. PERCIVAL, President of Trinity.
H D. HARPER, Principal of Jesus College.
G. E. THORLEY, Warden of Wadham.
EDWARD S. TALBOT, Warden of Keble.
WILLIAM INCE, Regius Professor of Divinity.
H. W. ACLAND, Regius Professor of Medicine.
W. H. FREEMANTLE, Fellow of Balliol College.
JOHN CONROY, Christ Church
ALFRED ROBINSON, Fellow of New College.
T. HERBERT WARREN, Fellow of Magdalene College.
F. MAX MÜLLER, Corpus Professor of Comparative Philology.
BARTHOLOMEW PRICE, Sedleian Professor of Natural Philosophy.
HENRY NETTLESHIP, Corpus Professor of Latin.
JAMES LEGGE, Professor of Chinese.
J. EARLE, Professor of Anglo-Saxon.
JOHN RHYS, Professor of Celtic.
T. H. T. HOPKINS, Fellow of Magdalen.
W. LOCK, Fellow of Magdalen College, Sub-Warden of Keble College.
W. W. JACKSON, Fellow of Exeter, Censor of Non-Collegiate Students.
H. F. TOZER, Fellow and Tutor of Exeter.
A. G. BUTLER, Fellow and Tutor of Oriel.
AUBREY MOORE, Tutor of Keble and Magdalen.
ROBERT L. OTTLEY, Student of Christ Church.
W. MARKBY, Reader in Indian Law, Fellow and Tutor of Balliol College, and Fellow of All Souls' College.
H. F. PELHAM, Exeter College.

THE MAXIM GUN

MR. HIRAM STEVENS MAXIM, the well-known American engineer, has lately brought out a new form of a machine-gun, which is attracting a great deal of attention in military and naval circles. This gun is a completely new departure. It takes the cartridges out of the box in which they were originally packed, puts them into the barrel, fires them, and expels the empty cartridges, using, for this purpose, energy derived from the recoil of the barrel. Of course it is necessary to put the first cartridge into the barrel by hand. When, however, this is done, and the trigger pulled, the gun will go on and fire as long as there are any cartridges in the box.